



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

NOVEMBER 2011

**MATHEMATICS P1
MEMORANDUM**

MARKS: 150

This memorandum consists of 9 pages.

QUESTION 1				
1.1	1.1.1	$2x^2 + 2x = 0$ $2x(x + 1) = 0$ $\therefore x = 0 \text{ or } x = -1$	✓ factorisation ✓✓ answers	(3)
	1.1.2	$x + 2 = \frac{6}{x}$ $x^2 + 2x - 6 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2b}$ $\therefore x = \frac{-2 \pm \sqrt{4 + 24}}{2}$ $= \frac{-2 \pm \sqrt{28}}{2}$ $= -3,6 \text{ or } 1,65$	✓ standard form ✓ formulae ✓ substitution ✓✓ answers	(5)
	1.1.3	$27^{\frac{2}{3}} \cdot 81^{-\frac{1}{2}} = 9^x$ $\therefore (3^3)^{\frac{2}{3}} \cdot (3^4)^{-\frac{1}{2}} = 3^{2x}$ $\therefore 3^2 \cdot 3^{-2} = 3^{2x}$ $\therefore 3^0 = 3^{2x}$ $\therefore x = 0$	✓ exponential form ✓ simplification ✓ simplification ✓ answer	(4)
	1.1.4	$\frac{10}{x-3} \geq 5$ $\therefore \frac{10}{x-3} - 5 \geq 0$ $\therefore \frac{10-5(x-3)}{x-3} \geq 0$ $\therefore \frac{10-5x+15}{x-3} \geq 0$ $\therefore \frac{-5x+25}{x-3} \geq 0$ $\therefore \frac{5(5-x)}{x-3} \geq 0$ $\therefore 3 < x \leq 5$	✓ RHK = 0 ✓ simplification ✓ simplification ✓ factorise numerator ✓ for 3 and 5 ✓ correct inequality signs	(6)
1.2	1.2.1	✓ ✓ ✓ $a = 0; a = 1; a = -1$		(3)

1.2.2	$\frac{a^2 - a^{-2}}{a - a^{-1}} = \frac{a^2 - a^{-1/2}}{a - \frac{1}{a}} \times \frac{a^2}{a^2}$ $= \frac{a^4 - 1}{a^3 - a}$ $= \frac{(a^3 - 1)(a^2 + 1)}{a(a^3 - 1)}$ $= \frac{a^2 + 1}{a}$	$\frac{a^{-2}(a^4 - 1)}{a^{-1}(a^2 - 1)}$ $= \frac{(a^2 - 1)(a^2 + 1)}{a(a^2 - 1)}$ $= \frac{a^2 + 1}{a}$	✓ multiply with $\frac{a^2}{a^2}$ ✓ product ✓ factorisation ✓ answer	(4)
1.3	$y - 2x + 1 = 0$ $y = 2x - 1$ Substitute into: $xy = 2y + x^2 + 3x - 10$ $\therefore x(2x - 1) = 2(2x - 1) + x^2 + 3x - 10$ $\therefore 2x^2 - x = 4x - 2 + x^2 + 3x - 10$ $\therefore x^2 - 8x + 12 = 0$ $\therefore (x - 6)(x - 2) = 0$ $\therefore x = 6 \text{ or } x = 2$ <p style="text-align: center;">and</p> $y = 2(6) - 1 \quad \text{or} \quad y = 2(2) - 1$ $= 12 - 1 \quad \text{or} \quad = 4 - 1$ $= 11 \quad \quad \quad = 3$	✓ making y the subject of the formulae ✓ substitution ✓ simplification ✓ standard form ✓ factors ✓ for both x values ✓ for both y values		
				[32]
QUESTION 2				
2.1	$y = -\frac{1}{2}x^2 + 2x + 4\frac{1}{4}$ $= -\frac{1}{2}\left(x^2 - 4x + \frac{17}{4}\right)$ $= -\frac{1}{2}\left(x^2 - 4x + 4 + 6\frac{1}{4} - 4\right)$ $= -\frac{1}{2}(x - 2)^2 + 4\frac{1}{4} + 2$ $= -\frac{1}{2}(x - 2)^2 + 6\frac{1}{4}$	✓ \div by $-\frac{1}{2}$ ✓ add & subtract square ✓ factorise 1 st 3 terms in bracket ✓ answer		(4)
2.2	Maximum : $a < 0$	✓ maximum ✓ < 0		(2)
2.3	$6\frac{1}{4}$	✓ answer		(1)
2.4	$\sqrt{6\frac{1}{4}} = \sqrt{\frac{25}{4}}$ $= \frac{5}{2}$	✓ $\sqrt{\frac{25}{4}}$ ✓ answer		(2)

2.5	$-\frac{1}{2}x^2 + 2x + 4\frac{1}{4} = 0$ $2x^2 - 8x - 17 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{8 \pm \sqrt{(-8)^2 - 4(2)(-17)}}{2(2)}$ $= \frac{8 \pm \sqrt{64 + 36}}{4}$ $= \frac{8 \pm \sqrt{200}}{4}$ $= \frac{8 \pm 14,14}{4}$ $= 5,5 \text{ or } -1,5$ <p>y – intercept: $x = 0$ $\therefore y = 4\frac{1}{4}$</p>		✓ simplification ✓ formulae ✓ substitution ✓ simplification ✓ for both values of x ✓ for y-value	(6)
				[15]
QUESTION 3				
3.1	$T_n = 3 \cdot 2^{n-1}$			
	3.1.1	3; 6; 12; 24	✓✓ one mark for 2 terms	(2)
	3.1.2	Multiply previous term by 2 or geometric sequence.	✓ answer	(1)
	3.1.3	45	✓ answer	(1)
	3.1.4	$T_n = 3 \cdot 2^{n-1}$ $6144 = 3 \cdot 2^{n-1}$ $2048 = 2^{n-1}$ $2^{11} = 2^{n-1}$ $n - 1 = 11$ $\therefore n = 12$ $\therefore T_{12} = 6144$	✓ subst. T_n with 6144 ✓ $2048 = 2^{n-1}$ ✓ same base ✓ equate exponents ✓ value of n	(5)
	3.2.1	8; 20; 38; 62; 92	✓ answer	(1)

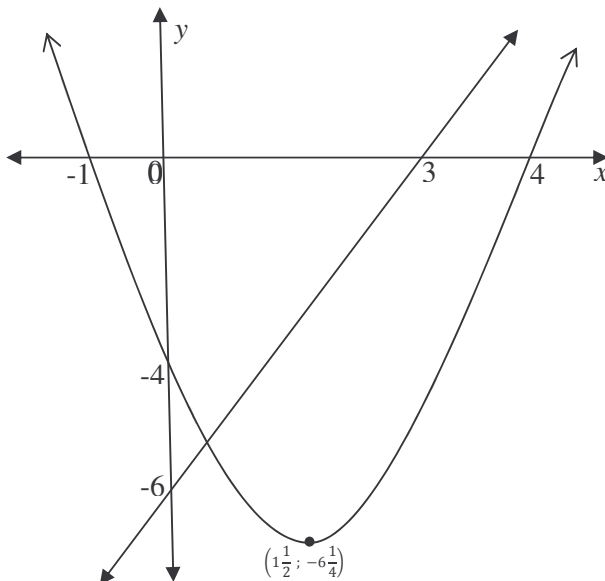
	3.2.2	$T_n = an^2 + bn + c$ $2a = 2^{\text{nd}} \text{ difference}$ $\therefore 2a = 6$ $\therefore a = 3$ $\therefore T_n = 3n^2 + bn + c$ $T_1 : 8 = 3(1)^2 + b(1) + c$ $\therefore b + c = 5 \quad (1)$ $T_2 : 20 = 3(2)^2 + b(2) + c$ $\therefore 2b + c = 8 \quad (2)$ From (1) $c = 5 - b \quad (3)$ Substitute (3) into (2) $\therefore 8 = 2b + (5 - b)$ $\therefore b = 3 \quad (4)$ Substitute (4) into (3) $\therefore c = 5 - 3$ $\therefore c = 2$ $\therefore T_n = 3n^2 + 3n + 2$	✓ value of a ✓ equation 1 ✓ equation 2 ✓ c in terms of b ✓ value of b ✓ value of c ✓ answer	(7)
	3.2.3	$T_{20} = 3(20)^2 + 3(20) + 2$ $= 1262$	✓ answer	(1)
				[18]

QUESTION 4				
4.1	4.1.1	$A = P(1 - in)$ $= 185\,000[1 - 4(0,2)]$ $= R37\,000$	✓ method and substitution ✓ answer	(2)
	4.1.2	$A = P(1 - i)^n$ $= 185\,000(1 - 0,2)^4$ $= R75776$	✓ method and substitution ✓ answer	(2)
4.2		$1 + i_e = \left(1 + \frac{inom}{m}\right)^m$ $1 + i_e = \left(1 + \frac{0,084}{12}\right)^{12}$ $1 + i_e = 1,08731\dots$ $\therefore \text{eff. rate} = 8,73\%$	✓ formulae ✓ substitution ✓ simplification ✓ answer	(4)
4.3	4.3.1	$A = P(1 - i)^n$ $= 39\,999\left(1 - \frac{0,18}{12}\right)^3$ $= R38\,225,91$	✓ formulae ✓ substitution ✓ answer	(2)
	4.3.2	$A = 39\,999\left(1 - \frac{0,18}{15}\right)^5$ $= 37\,087,732$ <p>Money lost = $39\,999 - 37\,087,732$</p> $= R2\,911,27$	✓ substitution ✓ simplification ✓ answer	(3)
4.4	<div style="text-align: center;"> 0 4 10 </div>	$A = P(1 + i)^n$ $28470 = P[(1 + 0,008)^{48}][(1 + 0,017225)^{24}]$ $28470 = P(1,008)^{48}(1,017225)^{24}$ $\therefore P = \frac{28470}{(1,008)^{48}(1,017225)^{24}}$ $\therefore P = R12\,890,61 \text{ of } R12\,890,60$	✓ method ✓ $(1008)^{48}$ ✓ $(1,024)^{24}$ ✓ simplification ✓ value of x ✓ sum invested	(6)
				[19]

QUESTION 5			
5.1	$g(x) = \frac{a}{x-b} + c$ $0 = \frac{a}{0-1} + 2$ $\therefore 0 = -a + 2$ $\therefore a = 2$ $\therefore \text{equation: } y = \frac{2}{x-1} + 2$	$\checkmark \quad b = 1$ $\checkmark \quad c = 2$ $\checkmark \quad \text{substitution of } (0 ; 0)$ $\checkmark \quad a = 2$ $\checkmark \quad \text{equation}$	(5)
5.2	$g(x) = (x - 1)^2 + q$ $0 = (2,5 - 1)^2 + q$ $\therefore q = -\frac{9}{4}$ $\therefore \text{Turning point} \left(1 ; \frac{9}{4}\right)$	$\checkmark \quad p = 1$ $\checkmark \quad \text{substitution of } (0 ; 0)$ $\checkmark \quad q = -\frac{9}{4}$ $\checkmark \quad \text{answer}$	(4)
5.3	$x = 2$ vertical asymptote $y = 2$ horizontal asymptote	$\checkmark \checkmark$ answers	(2)
5.4	$h(x) = -(x - 1)^2 + \frac{9}{4}$	\checkmark answer	(1)
			[12]

QUESTION 6			
6.1	$A = (0 ; 1)$ because $y = a^x$ $= a^0$ $= 1$	✓ A coordinate ✓ explanation	(2)
6.2	The sketch indicates a decreasing graph.	✓ explanation	(1)
6.3	B is the point $\left(4 ; \frac{1}{16}\right)$. $y = a^x$ $\frac{1}{16} = a^4$ $\left(\frac{1}{2}\right)^4 = a^4$ $\therefore a = \frac{1}{2}$	✓ substitution ✓ simplification ✓ answer	(3)
6.4	$y = \left(\frac{1}{2}\right)^{-x}$ $= 2^x$	✓ change of x sign ✓ simplified equation	(2)
6.5	(0 ; 1)	✓ x-coordinate ✓ y-coordinate	(2)
6.6	Domain: $(-\infty ; \infty)$ Range: $(0 ; \infty)$	✓✓ domain ✓✓ range	(4)
			[14]

QUESTION 7

QUESTION 7				
7.1	7.1.1	$y = a(x + 1)(x - 3) = ax^2 - 2ax - 3a$ substitute (0 ; -6) $6 = 0 - 0 - 3a$ $\therefore a = 2$ $\therefore f(x) = 2x^2 - 4x - 6$ $\therefore a = 2; b = -4; c = -6$	<ul style="list-style-type: none">✓ x- intercepts in factors✓ substitute (0 ; -6)✓ $a = 2$✓ equation✓ for both values of b and c.	(5)
	7.1.2	$PQ = g(x) - f(x)$ $= -x^2 + 5x - 1 - 2x^2 + 4x + 6$ $= -3x^2 + 9x + 5$ $PQ \text{ max. if } x = -\frac{b}{2a}$ $= -\frac{9}{-6}$ $= \frac{3}{2}$ $\therefore PQ_{\text{max}} = -3\left(\frac{3}{2}\right) + 9\left(\frac{3}{2}\right) + 5$ $= 11\frac{3}{4} \text{ units}$	<ul style="list-style-type: none">✓ $g(x) - f(x)$✓ simplification ✓ $-\frac{9}{-6}$✓ $\frac{3}{2}$✓ substitution ✓ answer	(6)
	7.2.1	$0 = 3m - 6$ $m = \frac{6}{3} = 2$	<ul style="list-style-type: none">✓ substitution of (3;0)✓ for m	(2)
	7.2.2			
			<ul style="list-style-type: none">✓ -1: x-intercept (par)✓ 4: x-intercept(par)✓ 6: y-intercept(par)✓✓ coordinates of TP✓ smooth curve	(6)
	7.2.3	See graph.	<ul style="list-style-type: none">✓ x-intercept (line)✓ y-intercept (line)	(2)
				[21]

QUESTION 8

8.1	✓ ✓ ✓ ✓ ✓ ✓ ✓	P(10 ; 25) Q(30 ; 15) S(40 ; 20) T(15 ; 45)	Two for each correct coordinate.	(8)
8.2	8.2.1	$W = 3x + 5y$	✓✓ for correct coefficients	(2)
	8.2.2	Gradient of search line: $-\frac{3}{5}$ Maximum at T For maximum profit: 15 skirts & 45 blouses	✓ 15 skirts ✓ 45 blouses	(2)
	8.2.3	Minimum at P 10 skirts 25 blouses Minimum profit = $3(10) + 5(25)$ $= 30 + 125$ $= R155,00$	✓ identification of minimum point ✓ 10 skirts ✓ 25 blouses ✓ substitution ✓ answer	(5)
8.3	45 blouses and 10 to 15 skirts		✓ 45 blouses ✓✓ 10 to 15 skirts	(3)
				[21]
			TOTAL:	150